## C. DOE AND EPRI R&D PLAN GOALS AND OBJECTIVES

This Appendix provides a review of the nuclear energy related strategic goals and objectives which were used in developing the goals and objectives of this Joint DOE-EPRI R&D Plan.

Nuclear Energy Goals from EPRI Report

The first set of goals presented here were developed in the "Nuclear Energy R&D Strategic Plan in Support of National Nuclear Energy Needs" (June 1997, EPRI). That Plan set forth fourteen goals, some of which were unique to the Federal Government and thus beyond the scope of this Joint R&D Strategic Plan. The first six goals related directly to commercial nuclear energy. Two of these (Goals 1 and 2) can be seen as primarily the responsibility of industry, and four (Goals 3-6) can be considered the joint responsibility of industry and government. The last three (Goals 7-9) are considered primarily government responsibilities. In addition, five important corollary goals were identified that must be pursued in parallel with the first nine strategic goals in order to realize the full potential of nuclear energy.

The *Strategic Goals* were used to define *R&D Objectives* that supported successful attainment of the goals. *R&D Action Plans* were then developed to meet near- and medium term *R&D Objectives*.

The ***National Nuclear Energy Goals*** set forth in that report were:

1. Maintain and improve the high safety and reliable performance of operating nuclear energy plants.

2. Improve the economic performance of operating nuclear energy plants.

3. Assure the continued availability of reliable and economic nuclear fuel. This objective includes optimizing the economics and performance of current nuclear fuel designs, and developing advanced LWR fuel cycle designs.

4. Enhance the investment in operating nuclear plants by maintaining a strong technical basis for continued operation beyond 40 years via stable and efficient license renewal programs, and by applying new technologies to improve the cost-effectiveness and predictability of the life extension option.

5. Achieve safe and cost-effective resolutions of technical issues associated with spent fuel and nuclear waste storage, transportation, and disposition, including high level and low level waste, decommissioning, and related cleanup standards.

6. Provide nuclear energy options to meet medium term (5 to 20 years) new baseload capacity additions as they develop.

7. Provide nuclear energy options to meet longer term (20 to 50+ years) energy needs, to include consideration of a full range of nuclear technologies and nuclear fuel cycles, a full range of plant sizes from large baseload units to small modular plants, and a broad range of uses from basic electricity generation to new energy applications (e.g., process heating, desalination, hydrogen production, isotopes).

### *International Nuclear Energy Goals*

8. Maintain strong support for the nuclear Non-Proliferation Treaty (NPT) and the U.S. obligations under the NPT to curb nuclear arms build-up, and to provide nuclear technology for peaceful uses to nations that promise not to develop nuclear weapons. Provide leadership in nuclear non-proliferation control, including prevention of horizontal proliferation, focused on the prompt reduction and dispositioning of excess weapons materials in the U.S., the former Soviet Union, and other weapons states.

9. Contribute to the safety of commercial nuclear power around the world, through leadership in safety technology and through direct assistance to nations with unsafe designs or inadequate safety regimes.

### *Corollary goals include:*

10. Achieve a more stable, focused, objective, and efficient regulatory process that incorporates risk-based and performance-based methodologies.

11. Maintain excellence in personnel training, occupational safety, management, and career progression so as to preserve the high quality and professionalism of the nuclear energy industry work force.

12. Assure the availability of energy to meet the global demands for adequate, reliable electric power generation and sustainable development, and to meet international obligations to reduce global warming emissions by utilization of nuclear power's non-combustible energy source.

13. Maintain effective, ongoing processes for transfer and application of technologies developed for advanced reactors to meet current plant needs, and for application of solutions developed for current plant issues to enhance future plant options.

14. Apply the U.S. technology used to address the above goals to foster increased international trade in superior U.S. nuclear technologies.

Each of these Goals was supported in the EPRI document by a set of R&D Objectives. The three primary Goals from above that form part of the basis for this Joint R&D Plan, Goals 3, 4, and 6, are repeated again here, along with their supporting R&D objectives:

**Goal 3: Assure the continued availability of reliable and economic nuclear fuel. This objective includes optimizing the economics and performance of current nuclear fuel designs, and developing advanced LWR fuel cycle designs.**

R&D Objectives

1. Assure a continuing stable and economic supply of nuclear fuel. Although no R&D is needed to assure an adequate fuel supply, R&D will be needed to control costs and improve reliability of nuclear fuel.

2. Continue R&D on nuclear fuel failure root cause and degradation investigation, in order to reduce both the rate and severity of fuel failures. Maintain international fuel collaboration programs to enhance understanding of fuel performance, analyze root causes and develop technical solutions for improving fuel reliability.

3. Maintain adequate R&D capabilities to address regulatory and licensing issues associated with fuel performance under operational transients, accident conditions, and reload analyses, especially at high burnups.

4. Continue R&D on improved cost-effective capabilities for fuel performance monitoring and predictive assessment for both in-core, and spent fuel storage situations.

5. Continue R&D on advanced fuel designs for LWRs that can achieve higher burnup/longer life, greater fuel utilization and higher reliability.

**Goal 4: Enhance the investment in operating nuclear plants by maintaining a strong technical basis for continued operation beyond 40 years via stable and efficient license renewal programs, and by applying new technologies to improve the cost-effectiveness and predictability of the life extension option.**

R&D Objectives

1. Conduct sufficient R&D on nuclear plant aging phenomena so as to provide utilities and NRC with the information and methods needed to predict and control long-term material condition. Develop and demonstrate effective methods for aging management.

2. Apply R&D results to pilot plants for demonstration of technology solutions to aging issues, and for testing License Renewal Rule technical requirements for generic application to other candidate plants.

3. Maintain and expand critical materials research in order to be prepared for new issues related to the performance of existing plant equipment (particularly, long-lived, passive components and structures), and to be prepared with repair and replacement options based on technologies that have been tested and approved by NRC, ASME, etc.

4. Resolve new technical issues that might arise during NRC review of a license renewal application.

**Goal 6: Provide nuclear energy options to meet medium term (5 to 20 years) new baseload capacity additions as they develop**.

R&D Objectives

1. Complete design certification engineering of ALWR designs and obtain acceptable design certifications (rule-makings) for each design. "Acceptable" in this context means that the design is acceptable to the NRC, and that the rule under which the design is to be implemented is judged to be practical and cost-effective by industry (see ALWR Strategic Plan Building Blocks 2 and 4).

2. Complete First-of-a-Kind Engineering (FOAKE) for the two ALWR designs selected for this additional work in 1993 (ABWR and AP600). (See ALWR Strategic Plan Building Block 6).

3. Conduct sufficient R&D in new state-of-the-art technologies that can be applied to ALWR designs to achieve clear economic competitiveness, as compared to all other energy supply options.

4. Conduct R&D in manufacturing infrastructure technologies that support both U.S. construction and U.S. exports of U.S. designs.

5. Evaluate options for further advances in the ALWR designs in the current ALWR program, to meet future contingencies. Possible contingencies that could require a commitment to more advanced ALWR developments include:

    - Future market requirements for passive ALWRs with a smaller or larger than 600 MWe plant electrical output

    - Innovations to improve ALWR electrical production efficiencies.

Nuclear Energy Goals from DOE Strategic Plan

Nuclear energy plays a significant role in DOE's current Strategic Plan, issued by Secretary Peña in September 1997. That plan presents Strategic Goals, Objectives, and Strategies for each of DOE's four business lines: Energy Resources, National Security, Environmental Quality, and Science and Technology. Commercial nuclear energy figures prominently in the Energy Resources business line. It also figures prominently in the Objectives listed under Environmental Quality, especially with regard to DOE's responsibilities to dispose of spent nuclear fuel. Also relevant to this Joint Plan are Strategies under the Science and Technology Business line that commit to increased collaboration and pursuit of technology research partnerships with industry, academia, and other agencies.

The five Objectives under DOE's Strategic Plan for its Energy Resources business line are:

1. Reduce the vulnerability of the U.S. economy to disruption in energy supplies
2. Ensure that a competitive electricity generation industry is in place that can deliver adequate and affordable supplies with reduced environmental impact.
3. Increase the efficiency and productivity of energy use, while limiting environmental impacts
4. Support U.S. energy, environmental, and economic interests in global markets.
5. Carry out information collection, analysis, and research that will facilitate development of informed positions on long-term energy supply and use of alternatives.

Clearly, nuclear energy and better information on the performance and economics of nuclear energy can make a major contribution to achieving each of these five Objectives.

Specific nuclear energy related strategies and performance measures are listed under Objective 2, 4, and 5. They are:

Objective 2, Strategy 7:
Improve nuclear power plant reliability and availability to increase the capacity factor of existing nuclear power plants from the 1996 average of 76 percent to 85 percent by 2010.

- ***!*** *By the end of FY 1999, identify at least three candidate advanced fuel cladding materials to support development of advanced, ultra-high burnup nuclear fuels*
- ***!*** *By the end of FY 2000, develop and demonstrate advanced balance-of-plant instrumentation and sensors in at least three plants.*
- ***!*** *By the end of FY 2000, coordinate with the Electric Power Research Institute and nuclear power utilities to accelerate the Nuclear Regulatory Commission certification of advanced digital instrumentation and control.*

Objective 2, Strategy 8:
Maintain a viable nuclear option for future, carbon-free baseload electricity through cooperative technical development activities with U.S. electric industry that would facilitate a U.S. order of an advanced nuclear power plant by 2010.

- ! *By the end of FY 1998, work with industry to facilitate NRC certification of the Westinghouse AP600 design for passively safe nuclear reactors*

- ! *By the end of FY 2000, design an economic data base to accurately model the schedule and cost of constructing an advanced nuclear power plant.*

Objective 4, Strategy 2:
Cooperate with foreign governments and international institutions to develop open energy markets, and facilitate the adoption and export of clean, safe, and efficient energy technologies and energy services.

- ! *By the end of FY 1998, support implementation of U.S. government agreements with Asian-Pacific countries that open enhanced market opportunities for U.S. nuclear industrial suppliers, enabling them to exchange information and export U.S. light water reactor technology and services, contributing to a four-fold increase in U.S. nuclear-related exports (from $1.2 billion in 1997) to $4.8 billion by 2005.*

Objective 5, Strategy 2:
Carry out research and scenario analysis to help identify and understand options that could revolutionize 21st century energy markets.

- ! *In FY 1999, conduct analyses to identify research needs, environmental benefits and economic factors associated with the deployment of advanced nuclear energy systems for the post-2030 period.*